Chesapeake Light Tower Bio-optics

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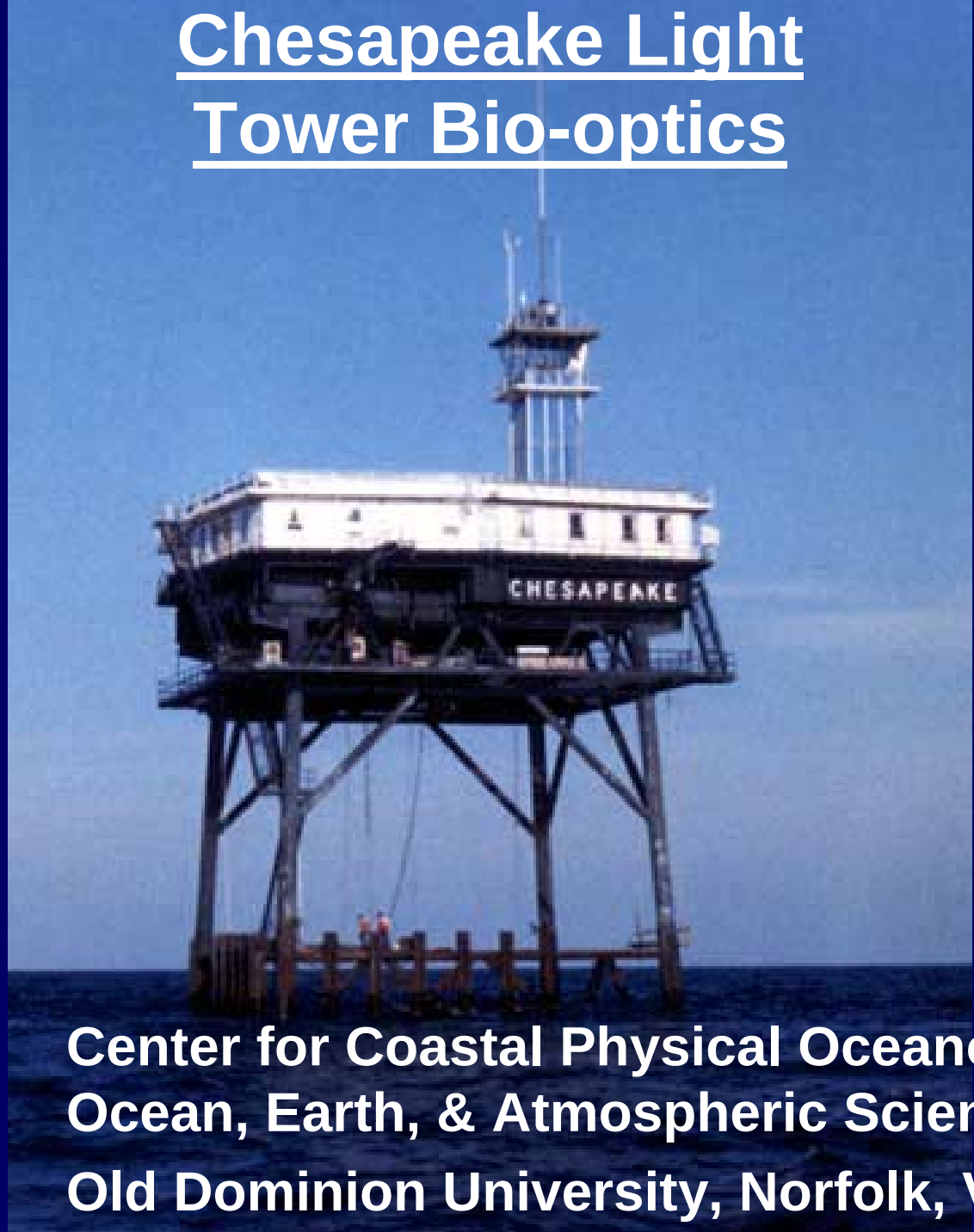
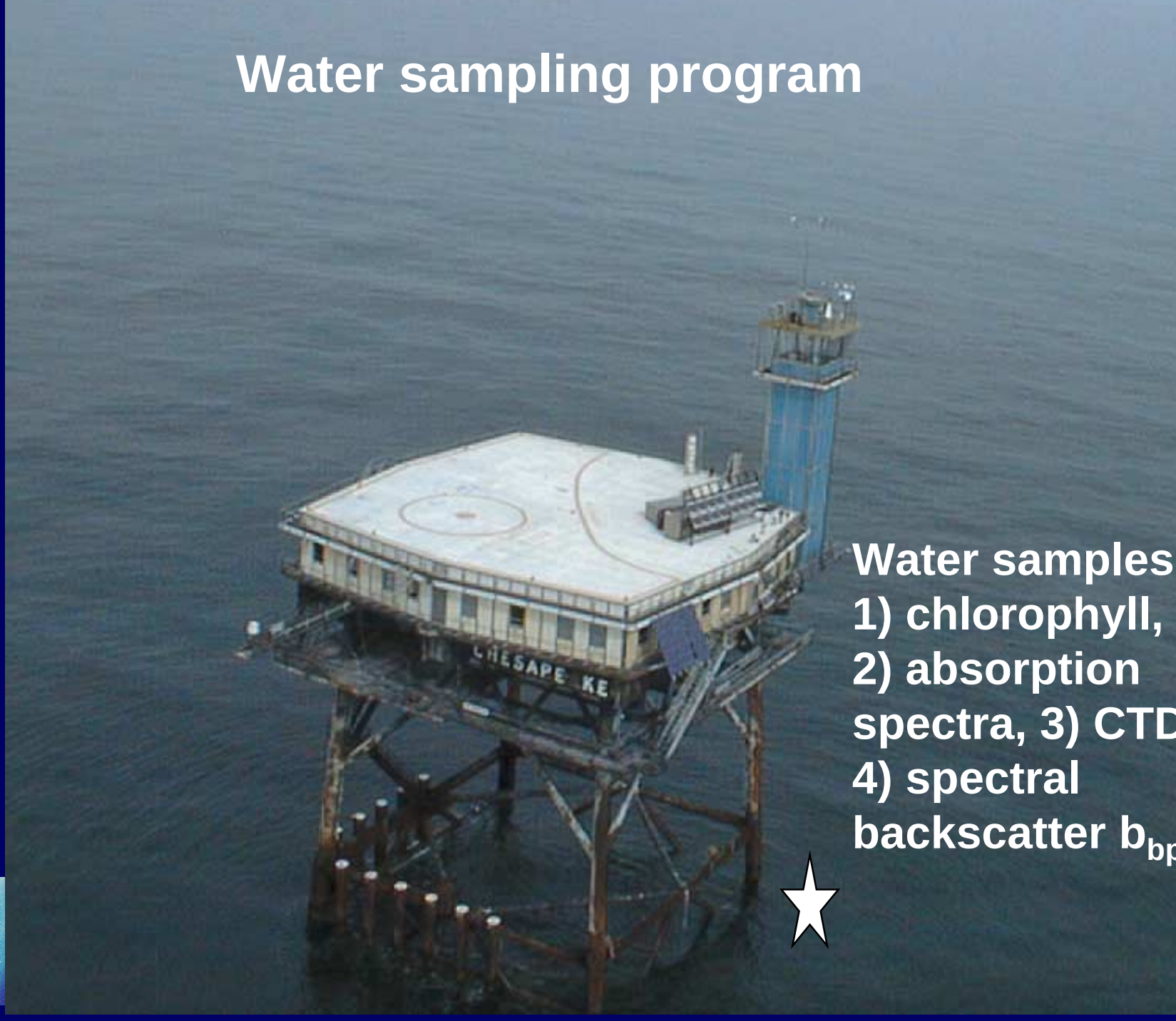


Goal: Biological dynamics with ocean color

Supported by NASDA

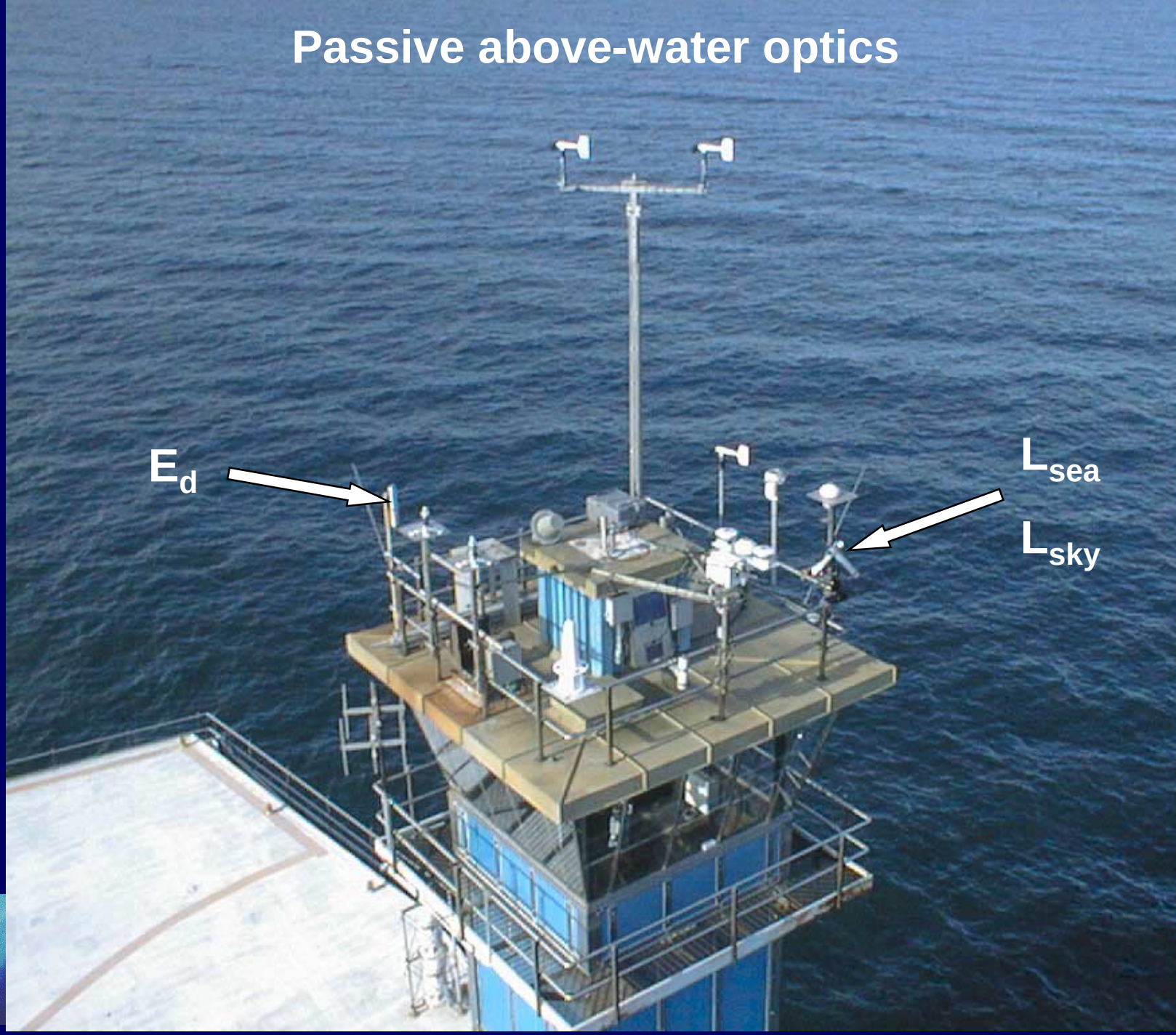
Center for Coastal Physical Oceanography,
Ocean, Earth, & Atmospheric Sciences,
Old Dominion University, Norfolk, VA

Water sampling program



Water samples
1) chlorophyll,
2) absorption spectra, 3) CTD
4) spectral backscatter b_{bp}

Passive above-water optics



Up- & Downwelling Radiances

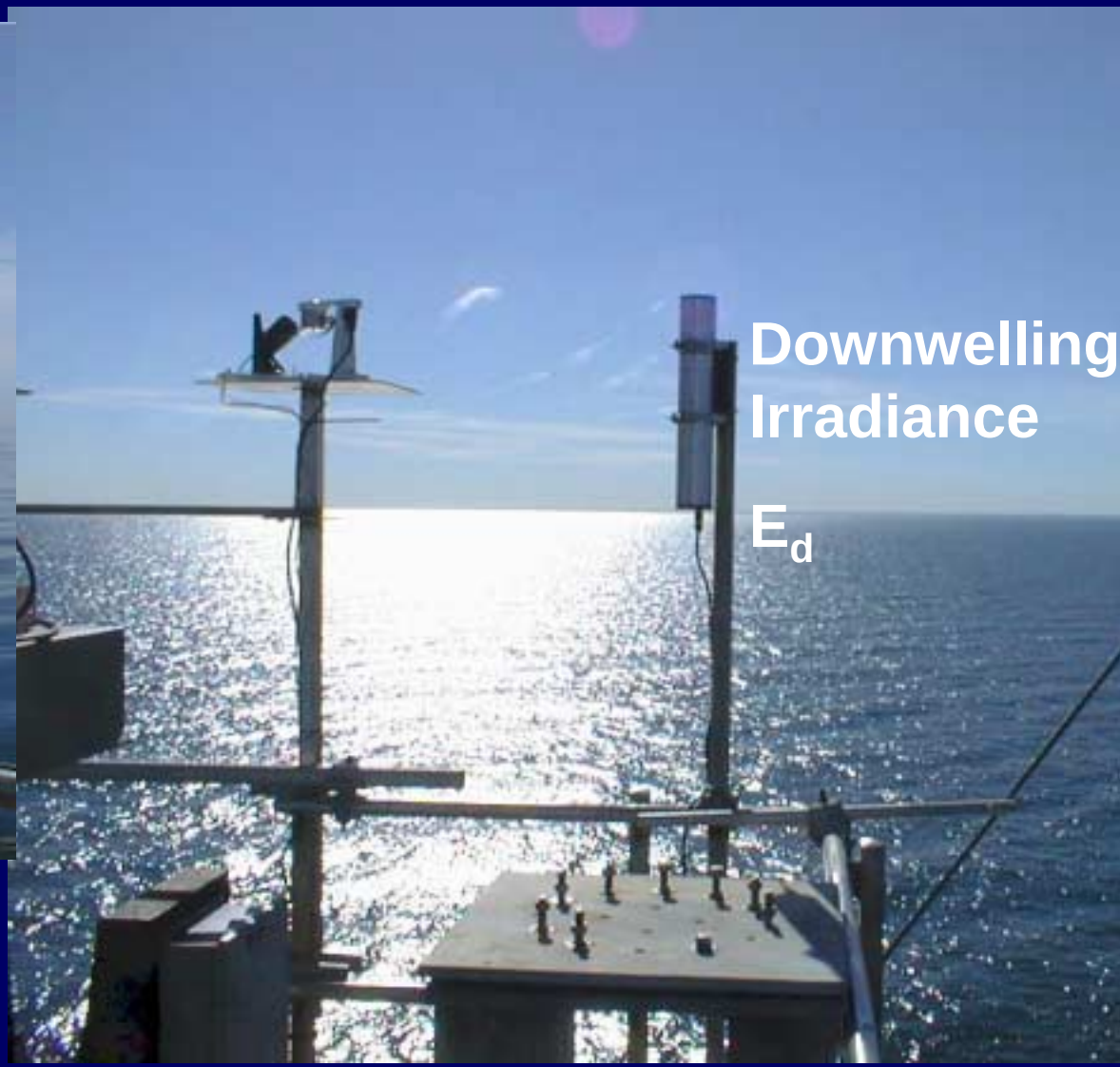
Sky

L_{sky}

Water

L_{sea}

L_{sea} corrected for Fresnel reflectance



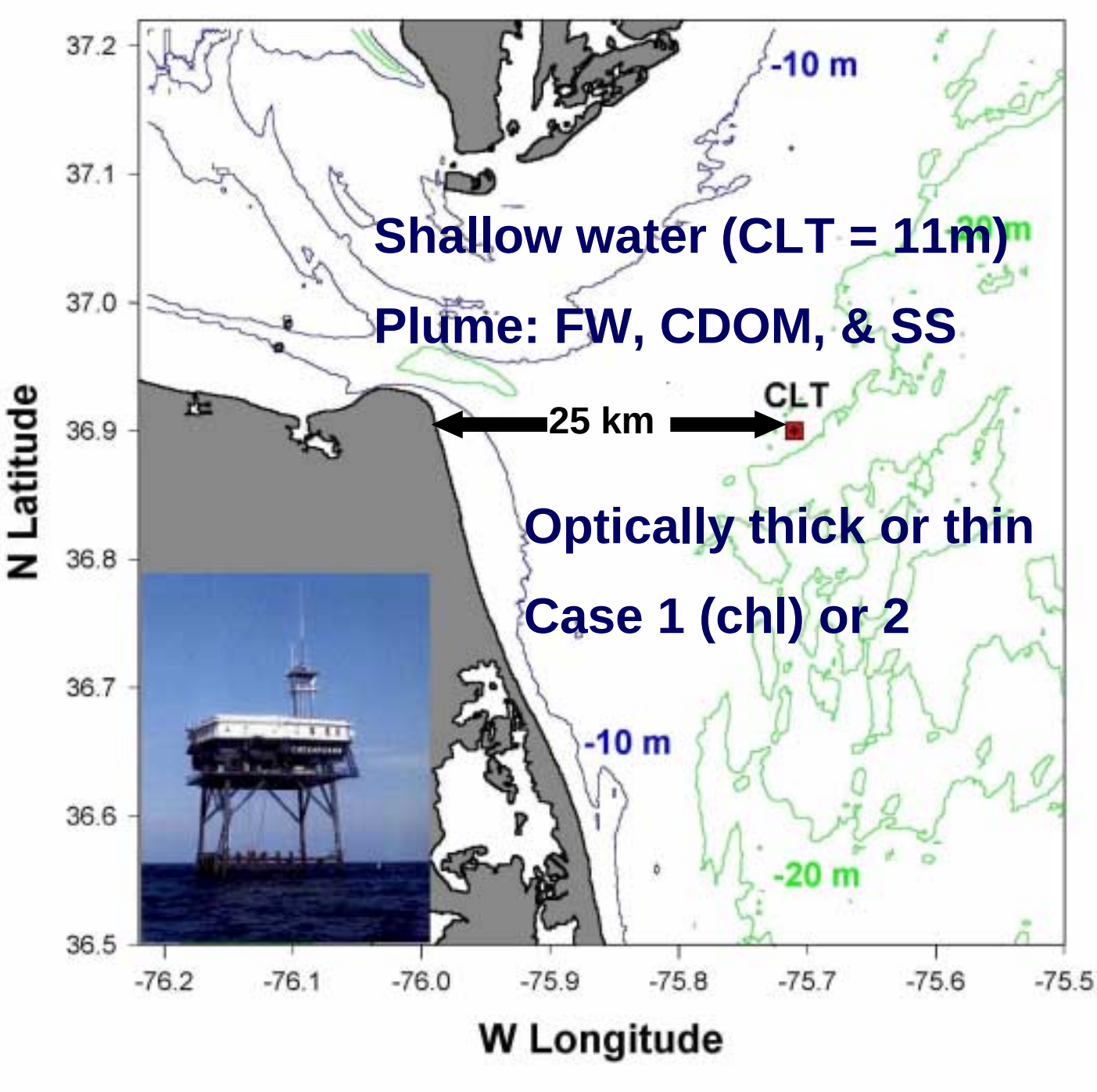
Downwelling Irradiance

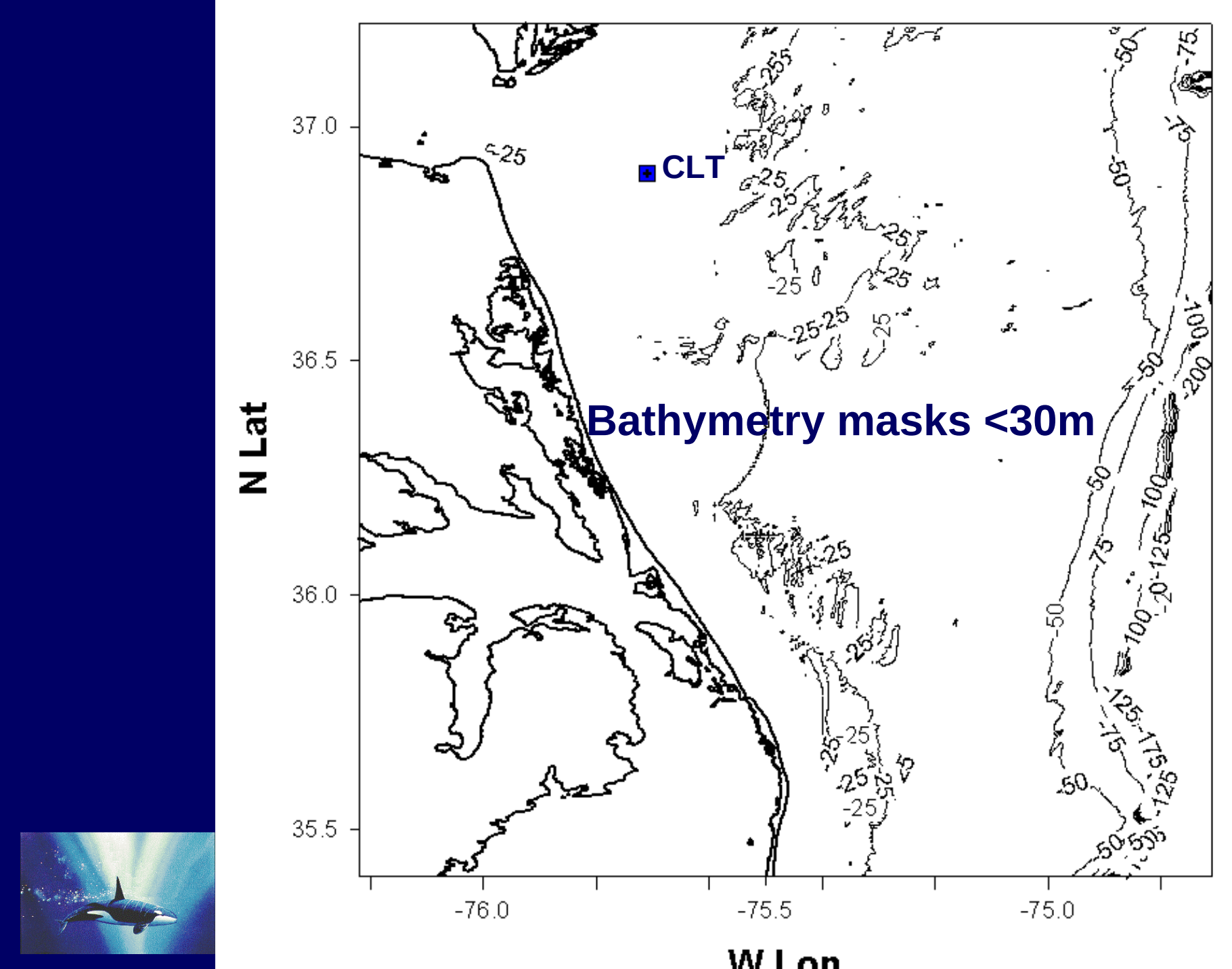
E_d

Radiance & Irradiance Sensors

Coastal waters can be extremely dynamic and complex!

(layers, runoff, mixing, etc., etc.)

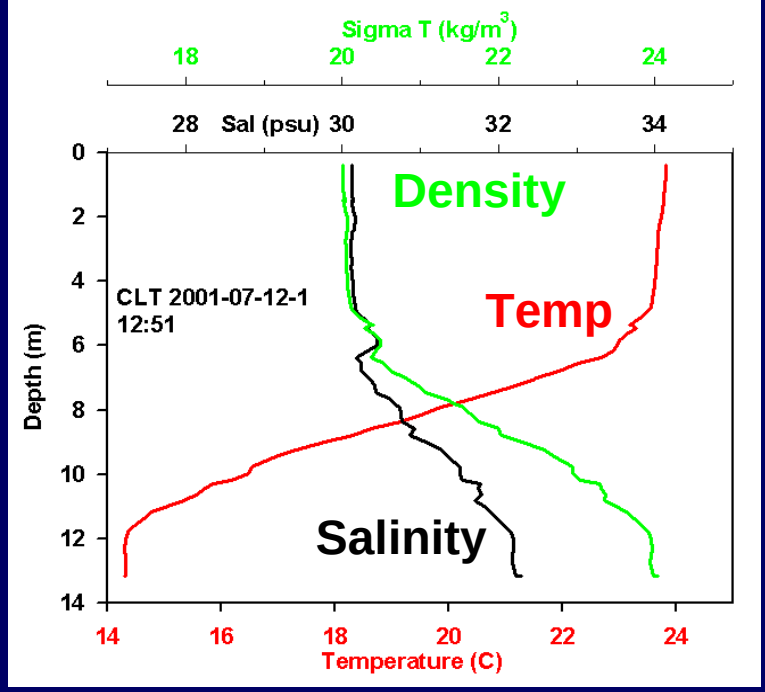


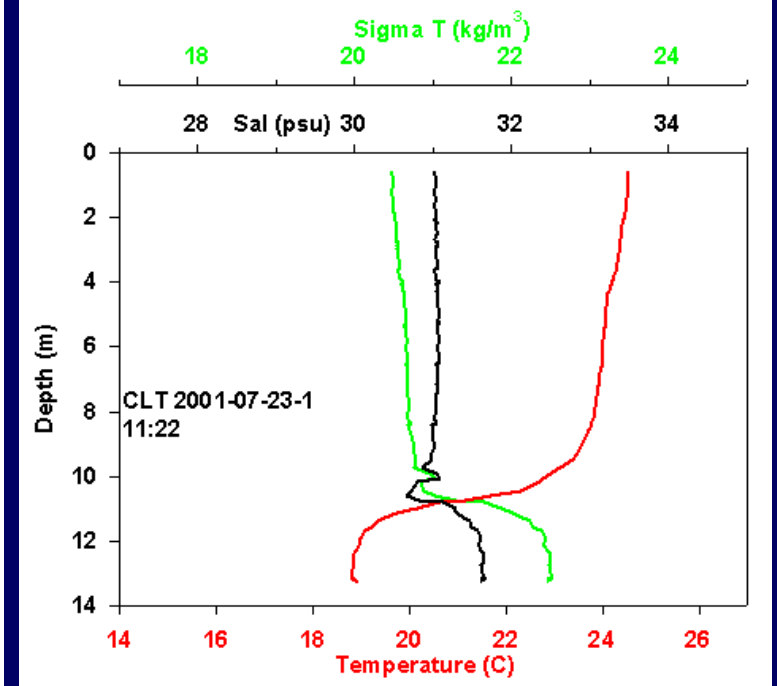

CLT
Bathymetry masks <30m
N Lat
W Lon
37.0
36.5
36.0
35.5
-76.0
-75.5
-75.0

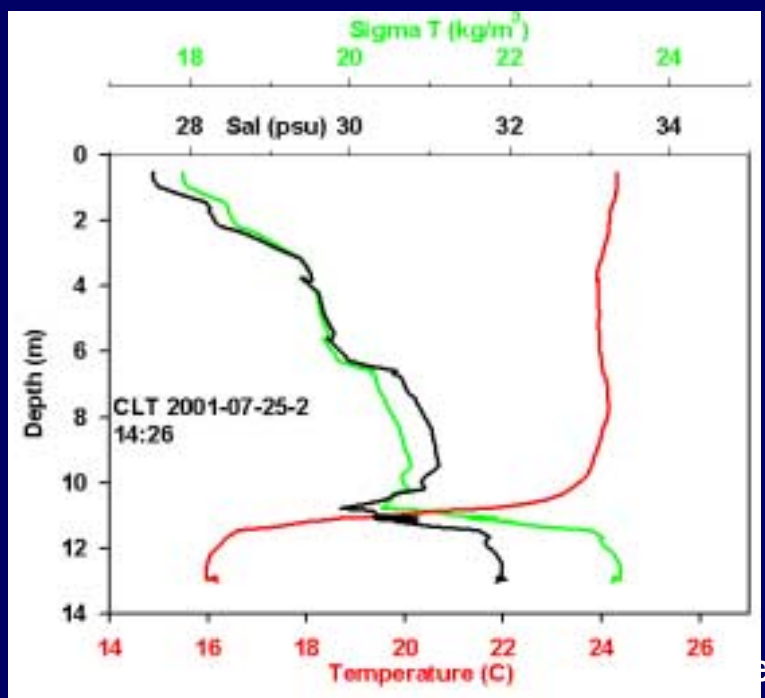
Water column structure

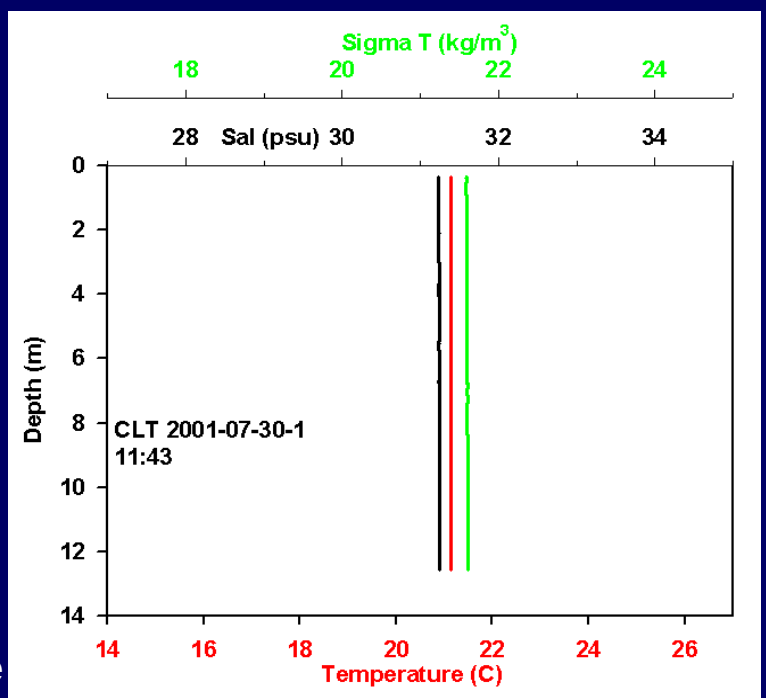
July 12, 23, 25 & 30th

1, 2, 3 or more layers



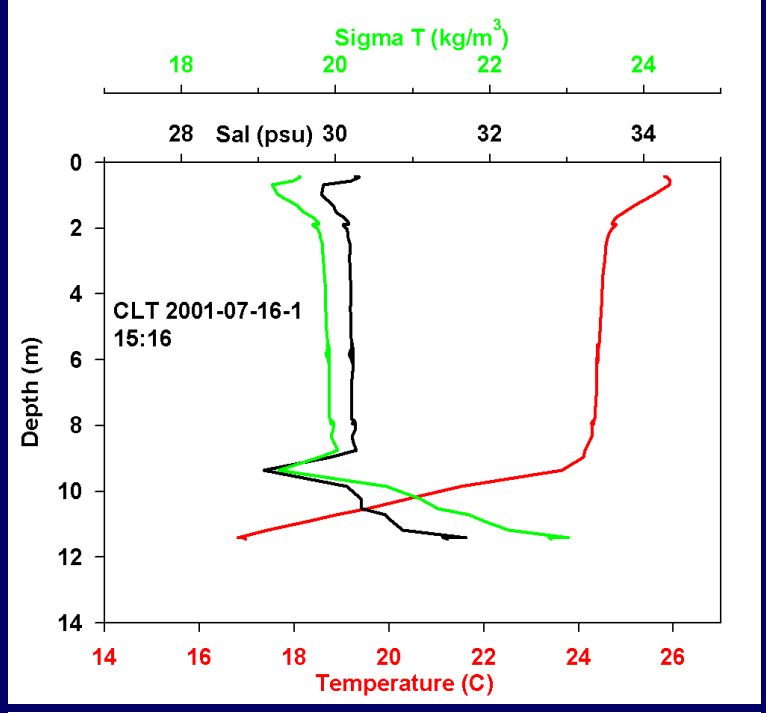


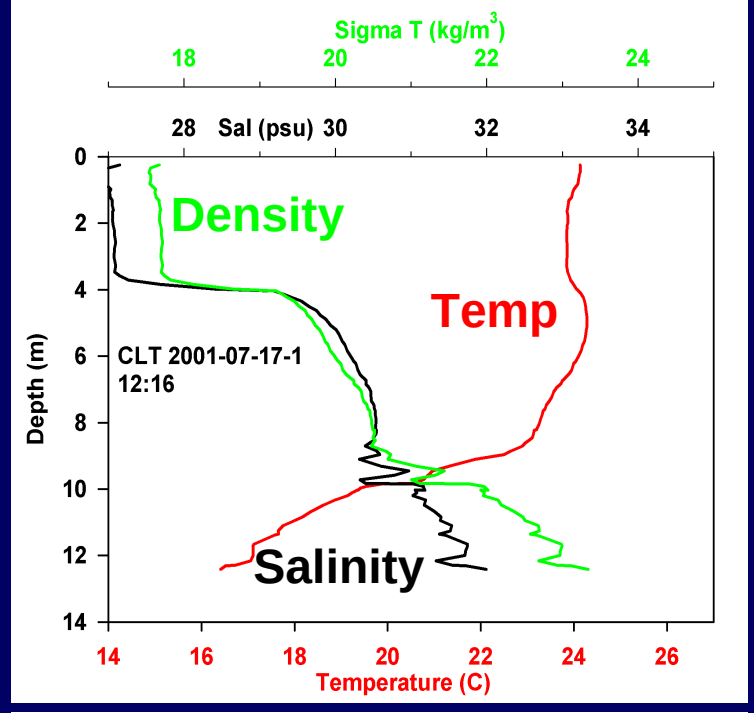


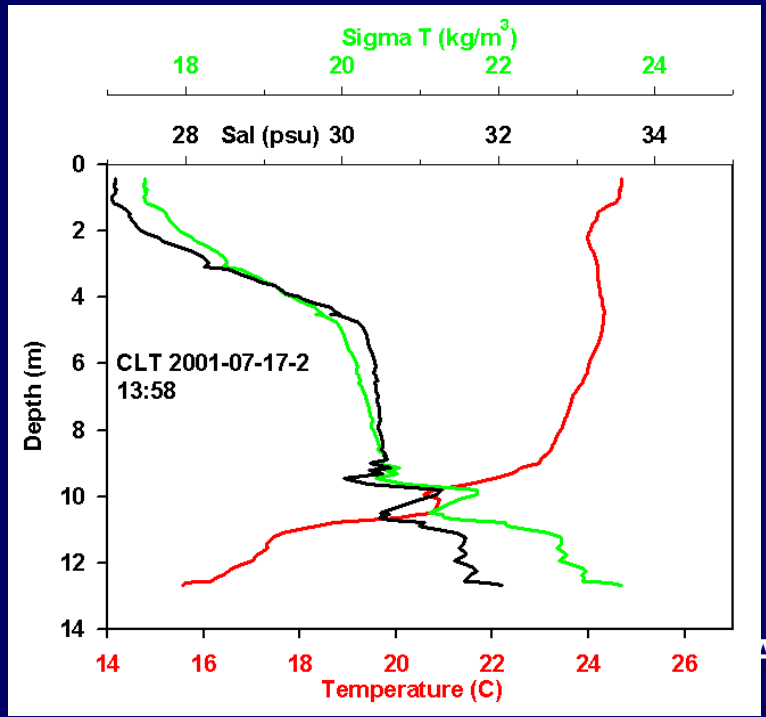


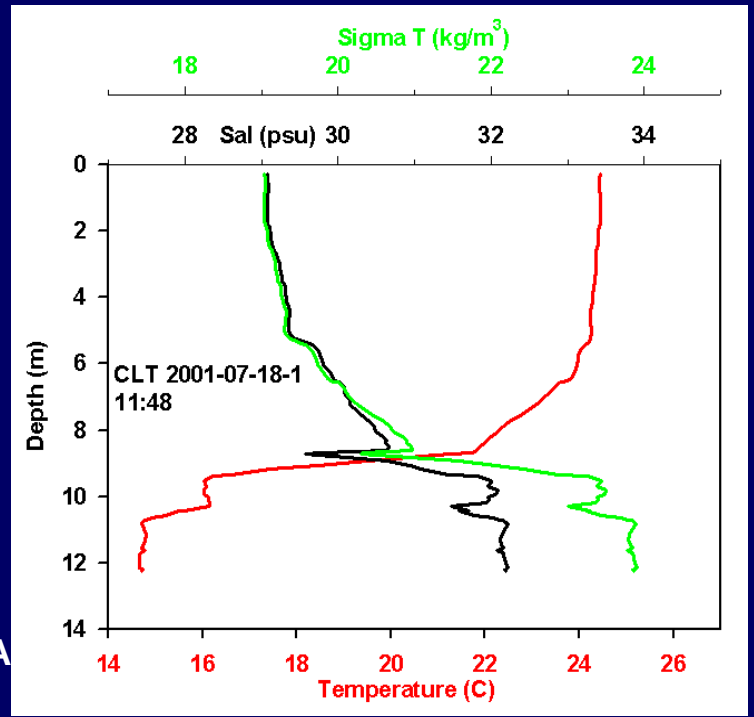
July 16-18th

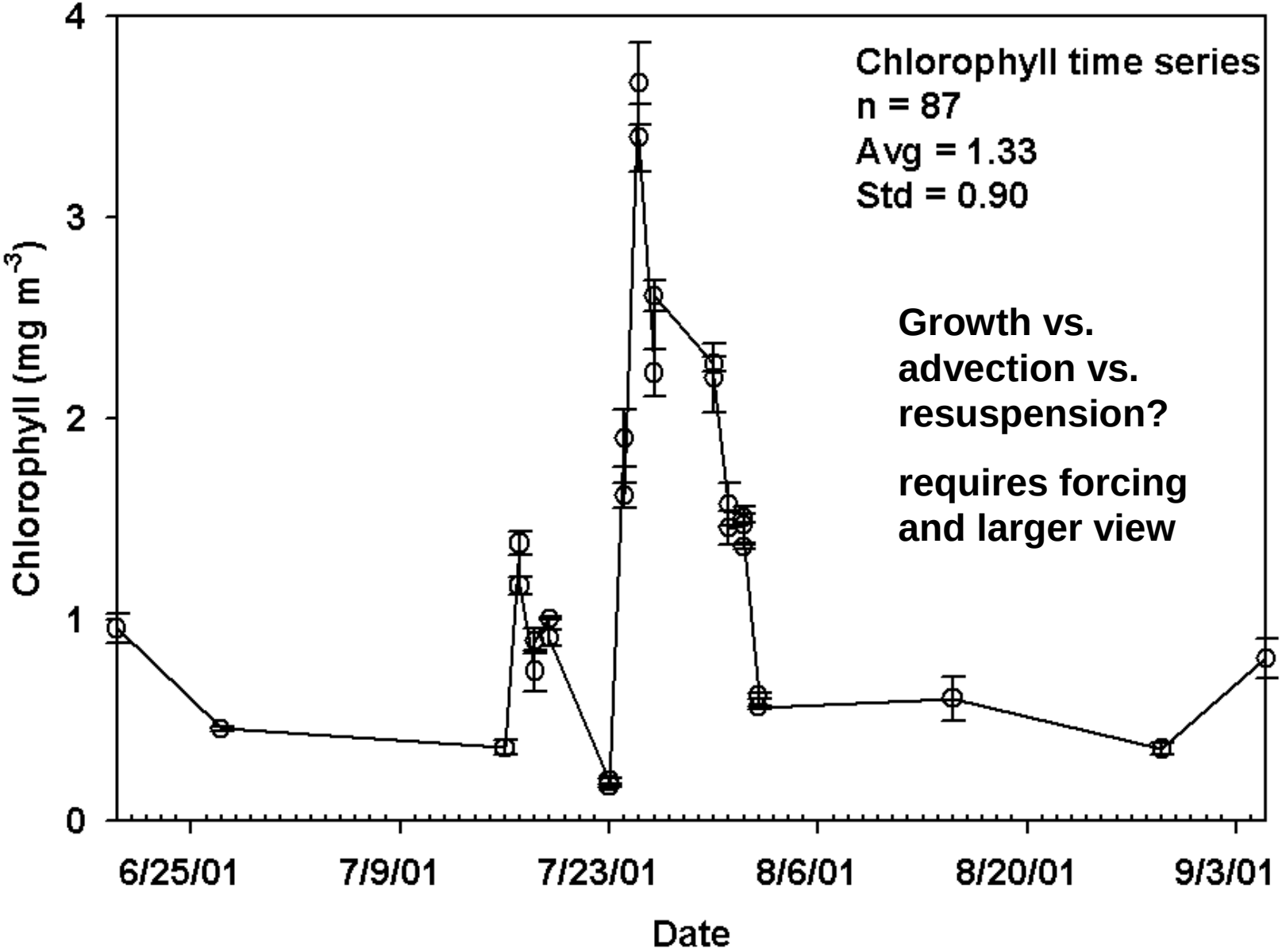
Short-term variability pronounced



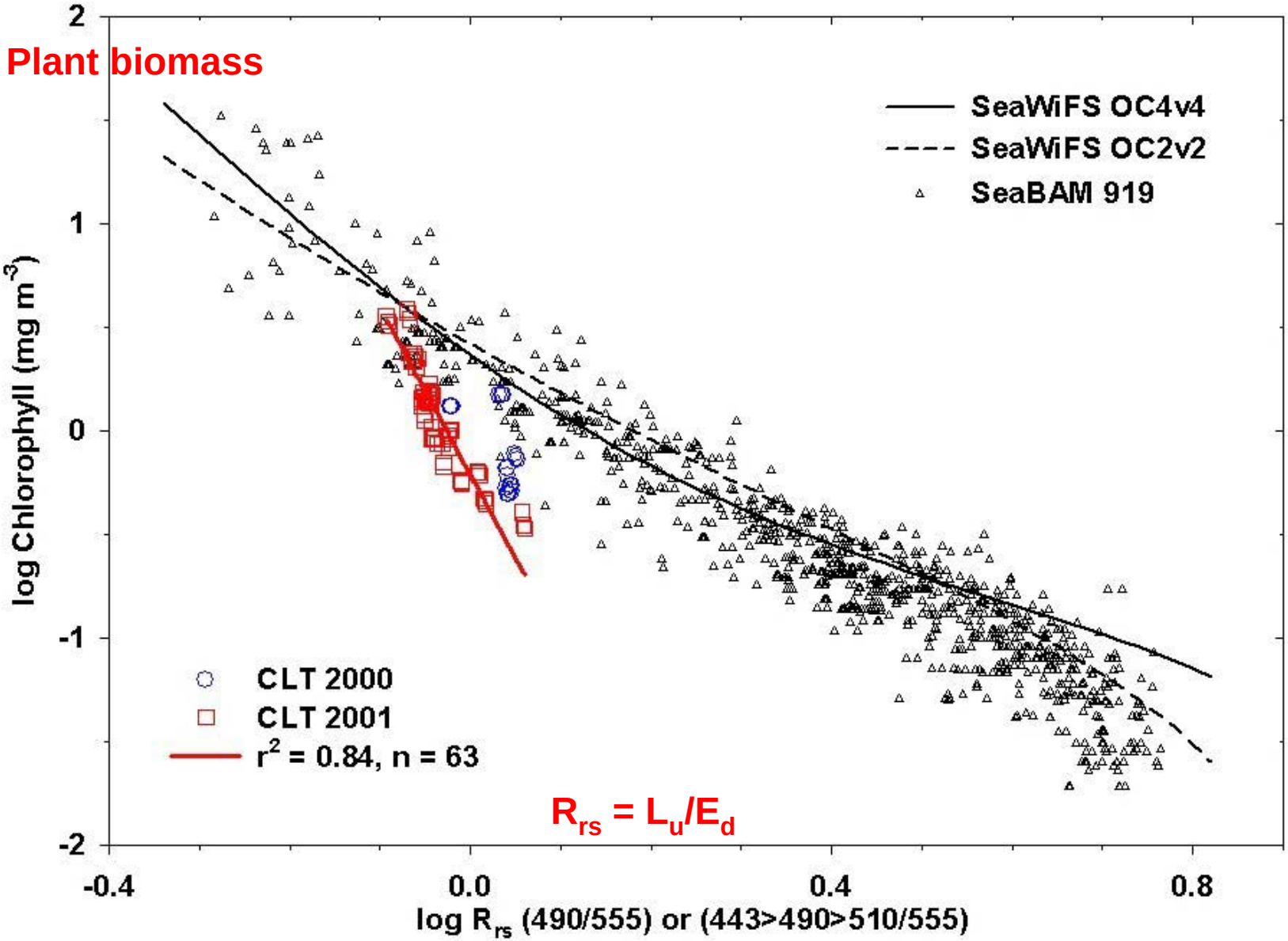




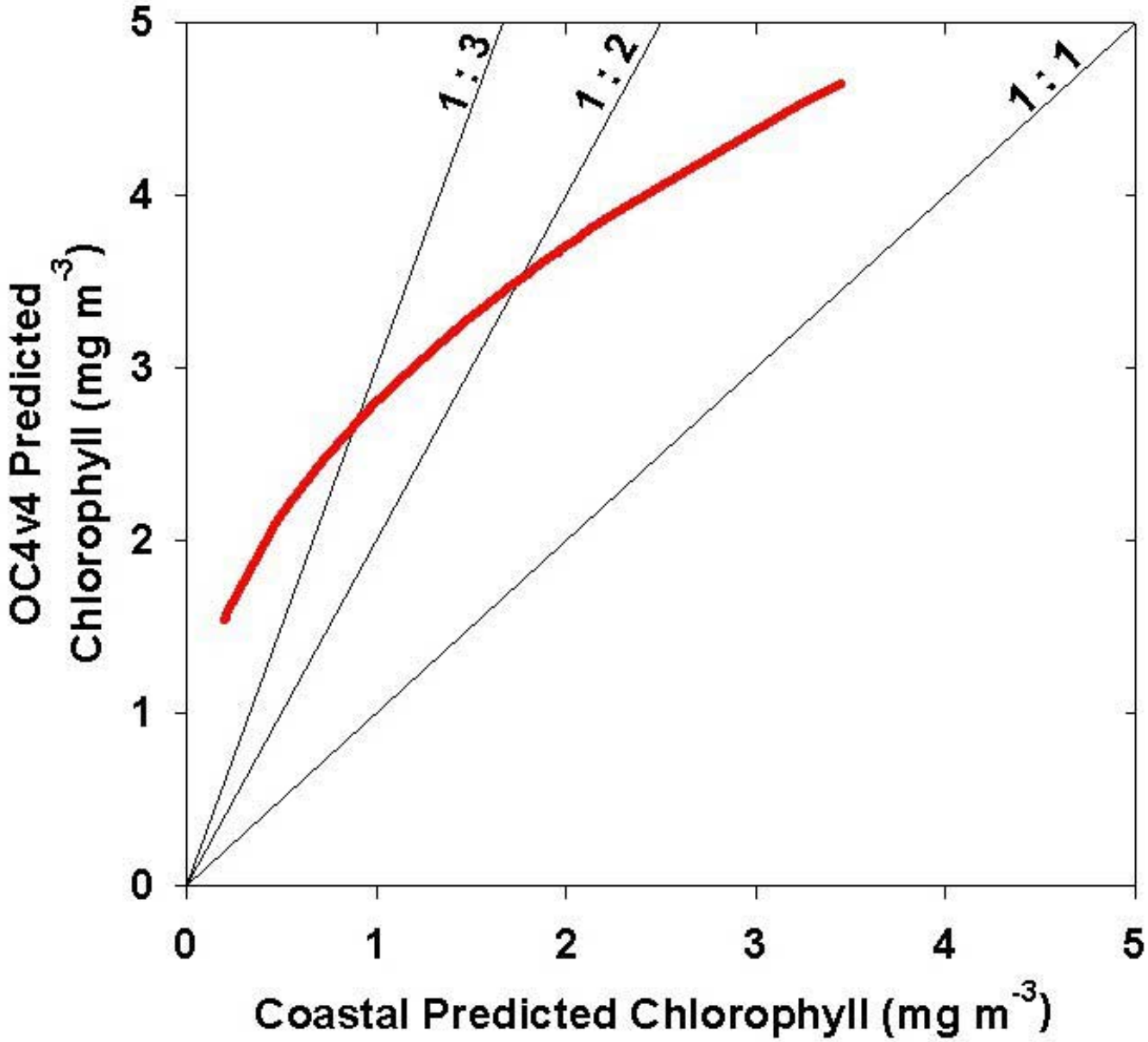




Plant biomass (chlorophyll) vs. time



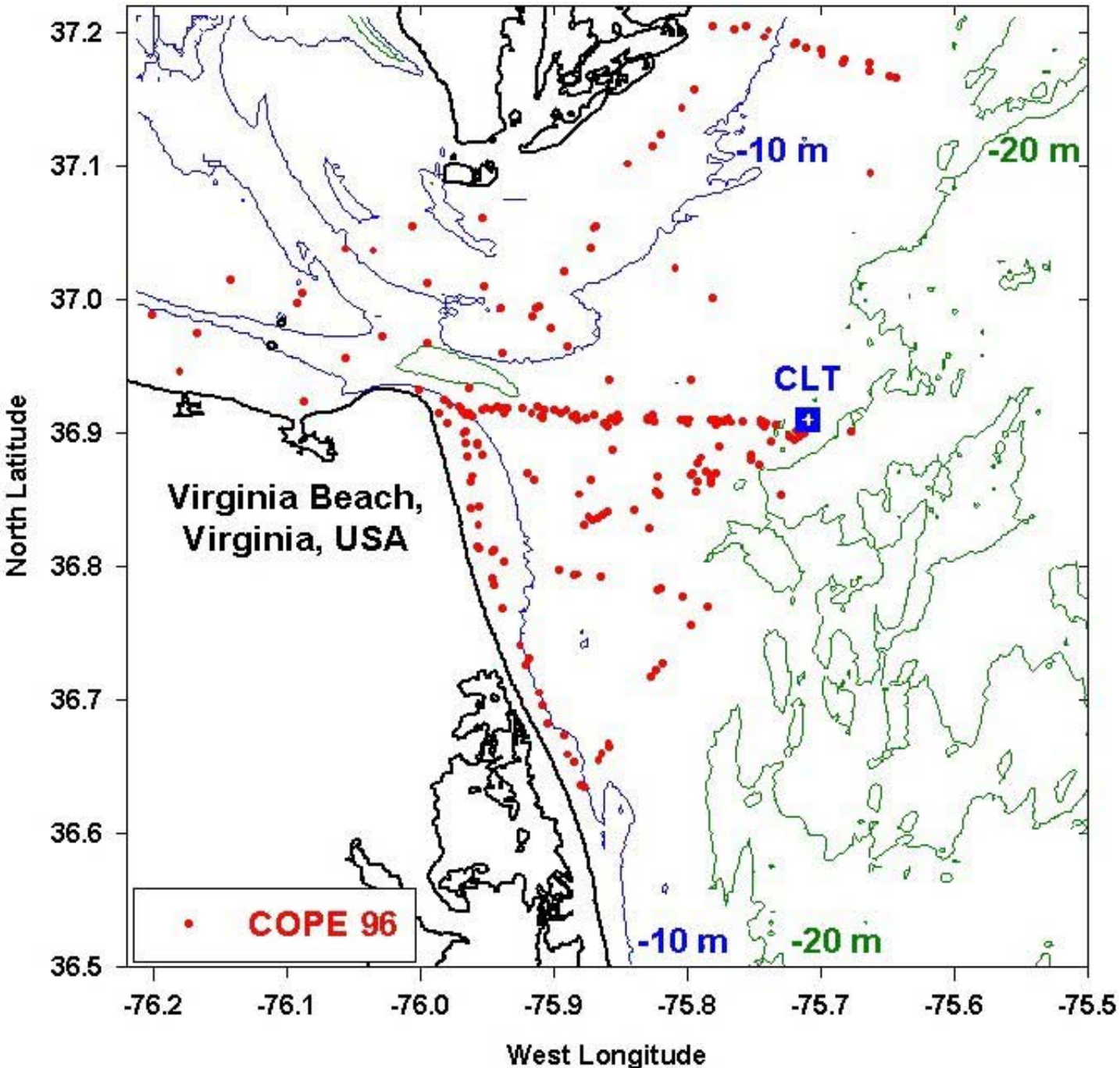
Coastal versus “global” ocean data

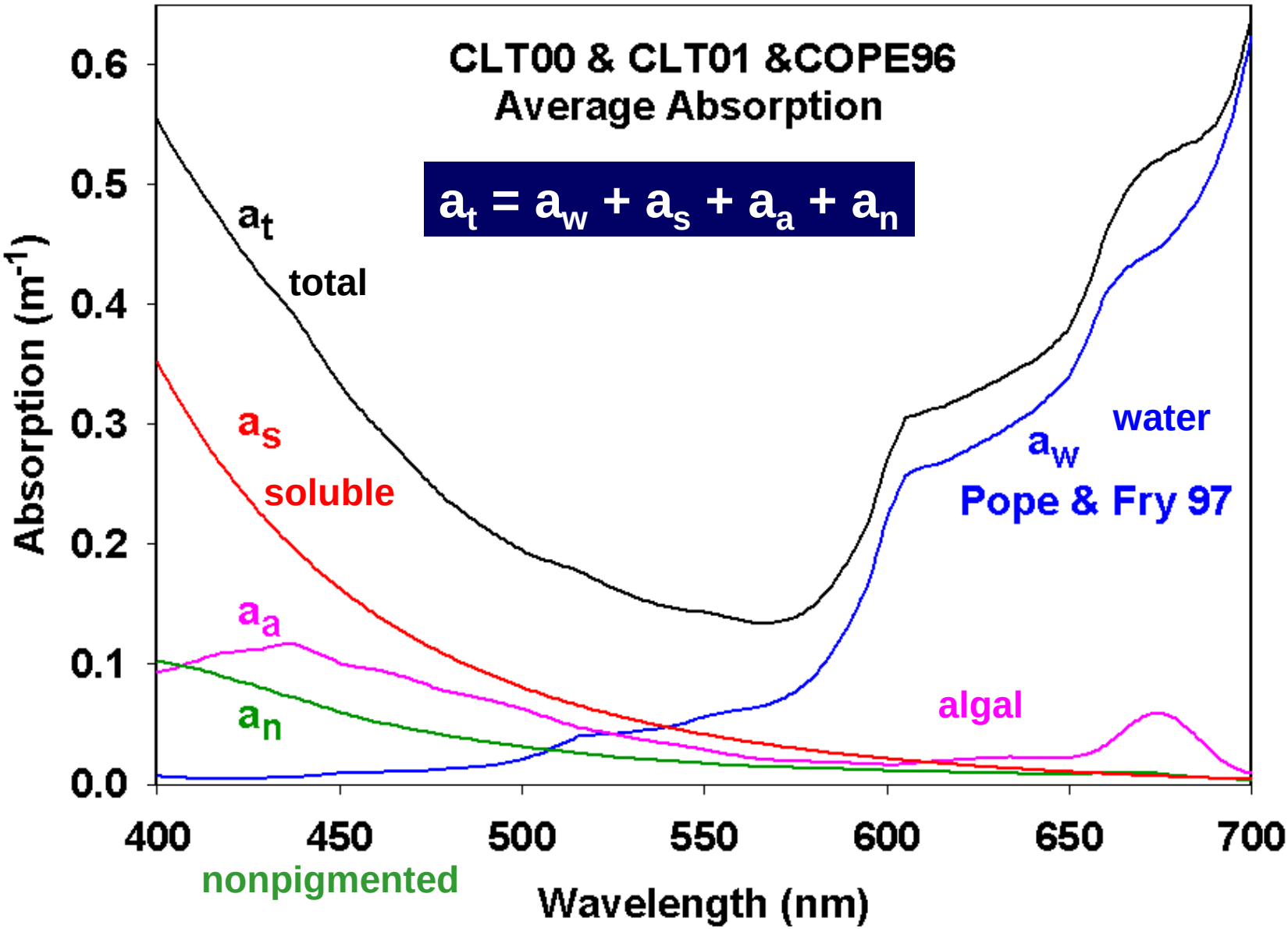


“global” algorithm overpredicts coastal biomass

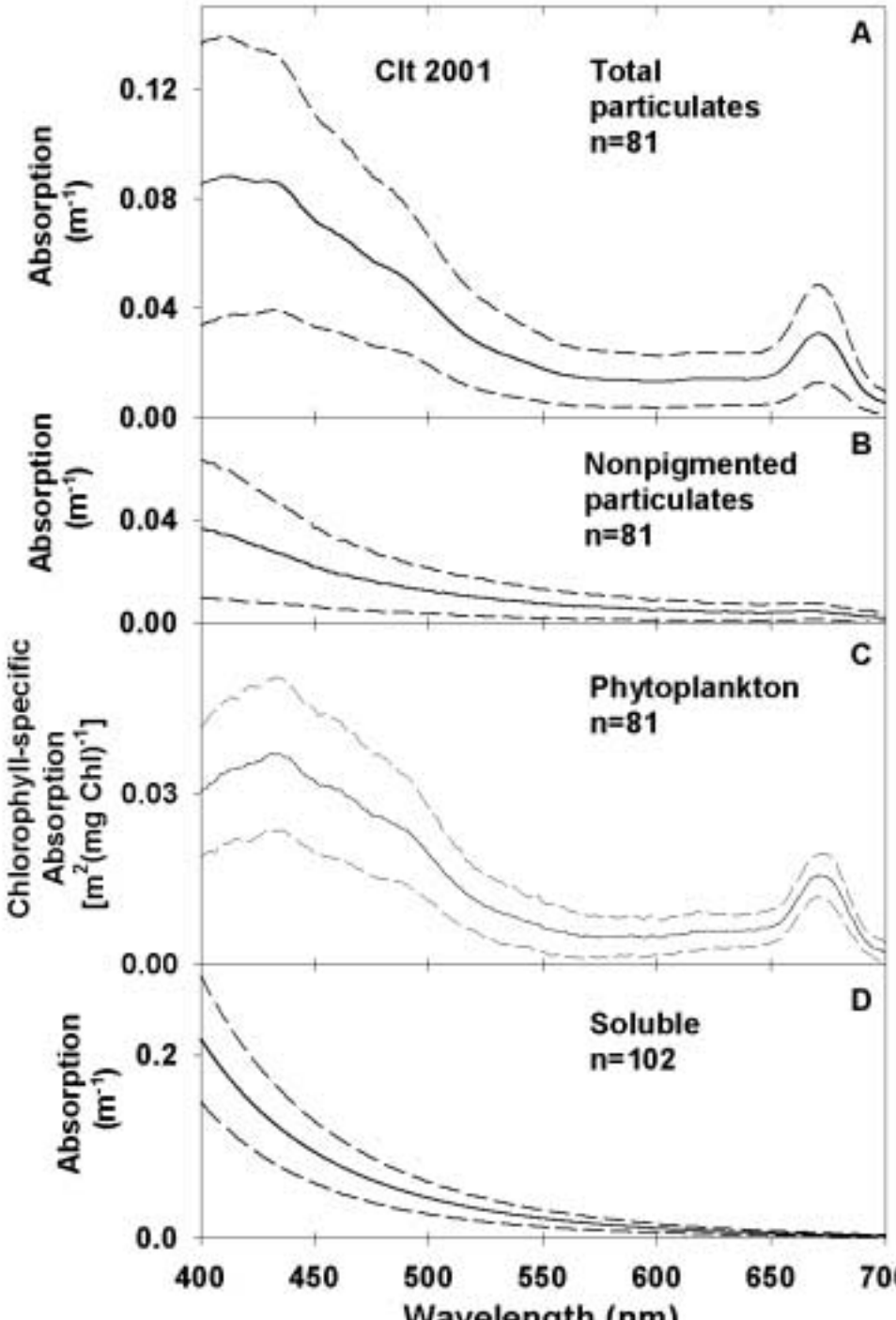
Chesapeake Outflow Plume Experiment in Sept 1996

Spatial variability is highly pronounced in shallow estuarine waters





Partitioning absorption by constituents



All particles

Particles - pigments = bacteria, detritus, sediments, animals

Plants

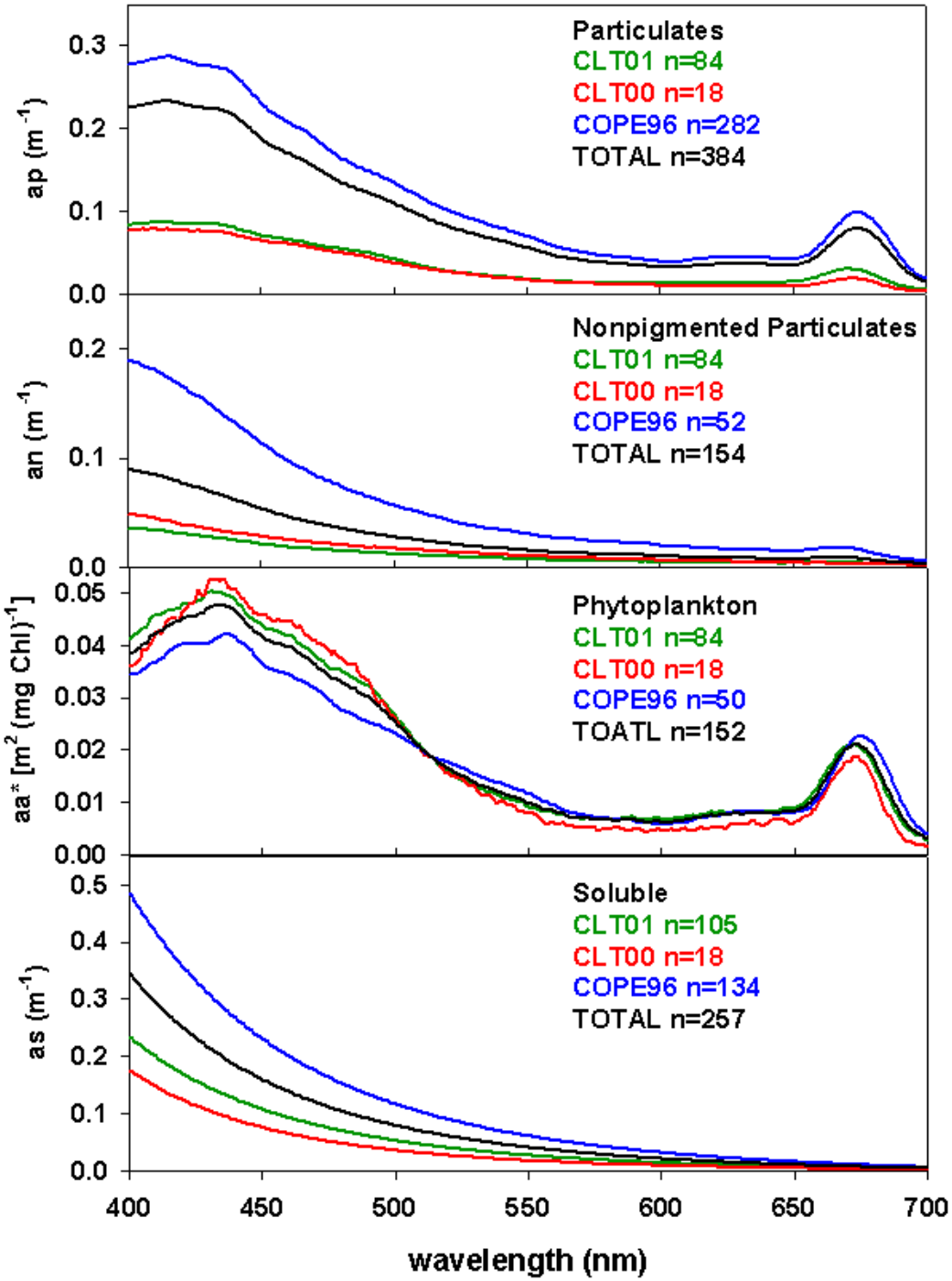
Soluble (CDOM)

400-700 nm

COPE96
Sept

CLT00
March

CLT01
Jun-Dec

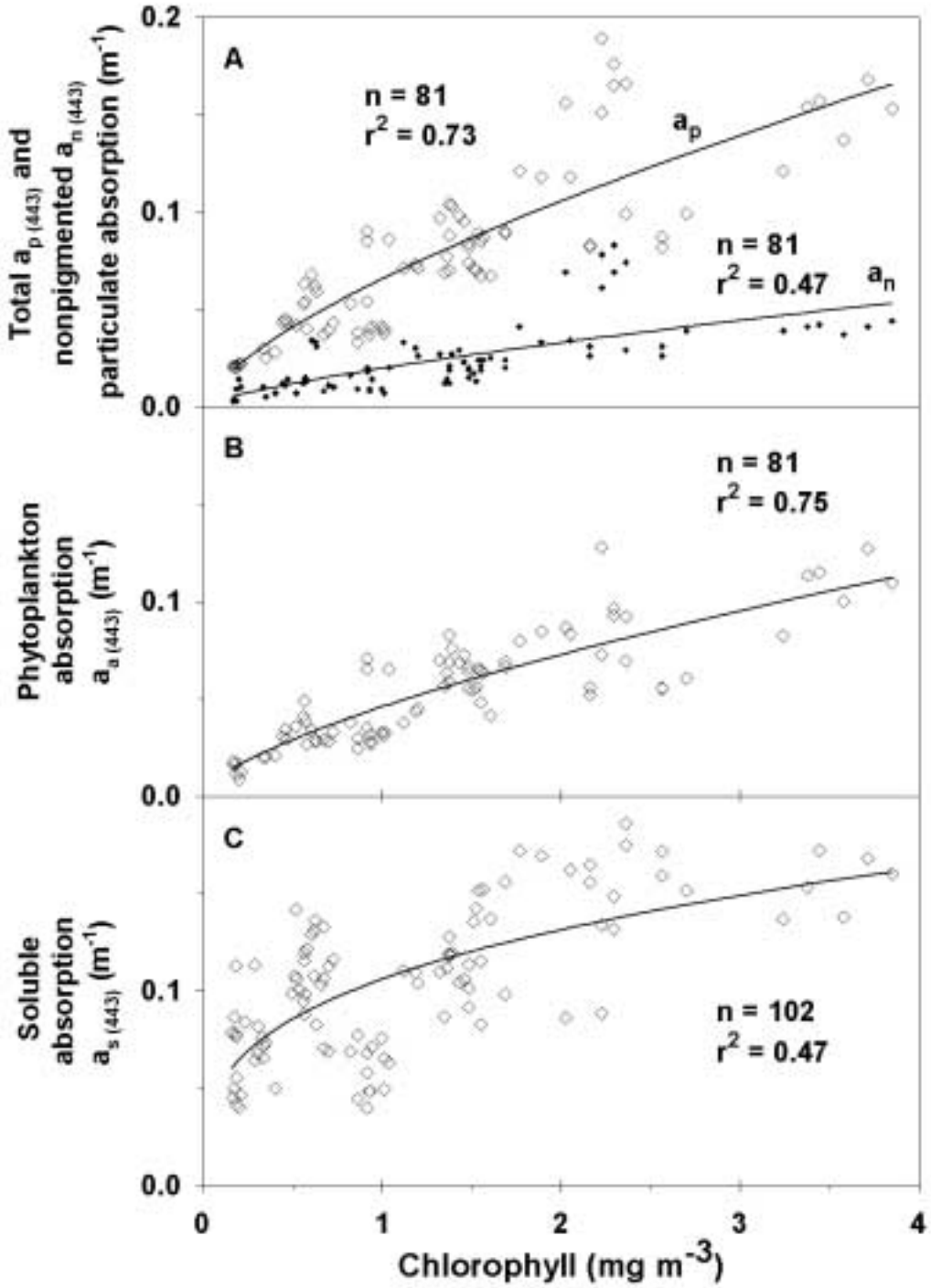


All particles

Particles - pigments = bacteria, detritus, sediments, animals

Plants

Soluble (CDOM)



All particles

Particles - pigments

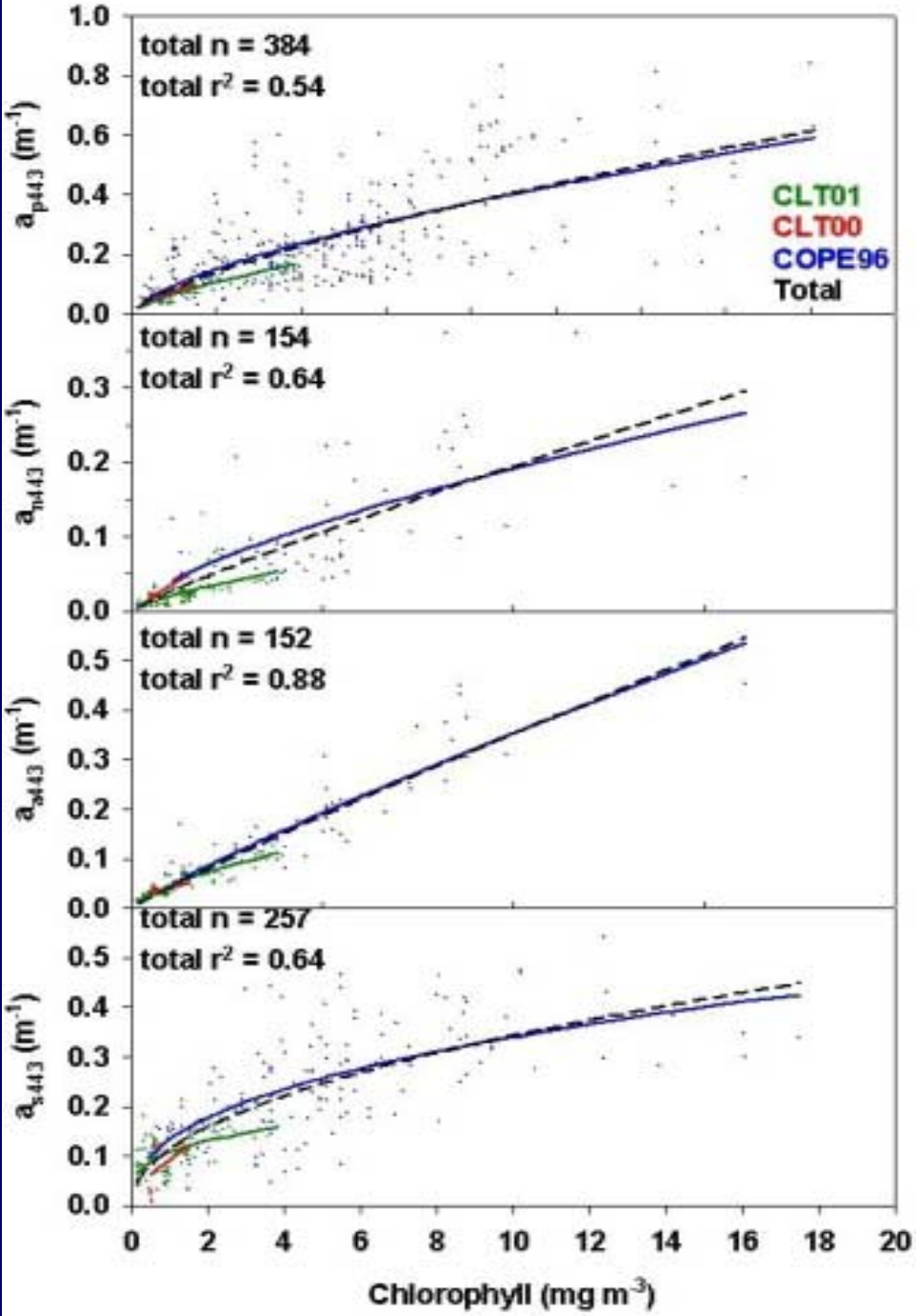
Plants

Soluble

COPE96
Sept

CLT00
March

CLT01
Jun-Dec

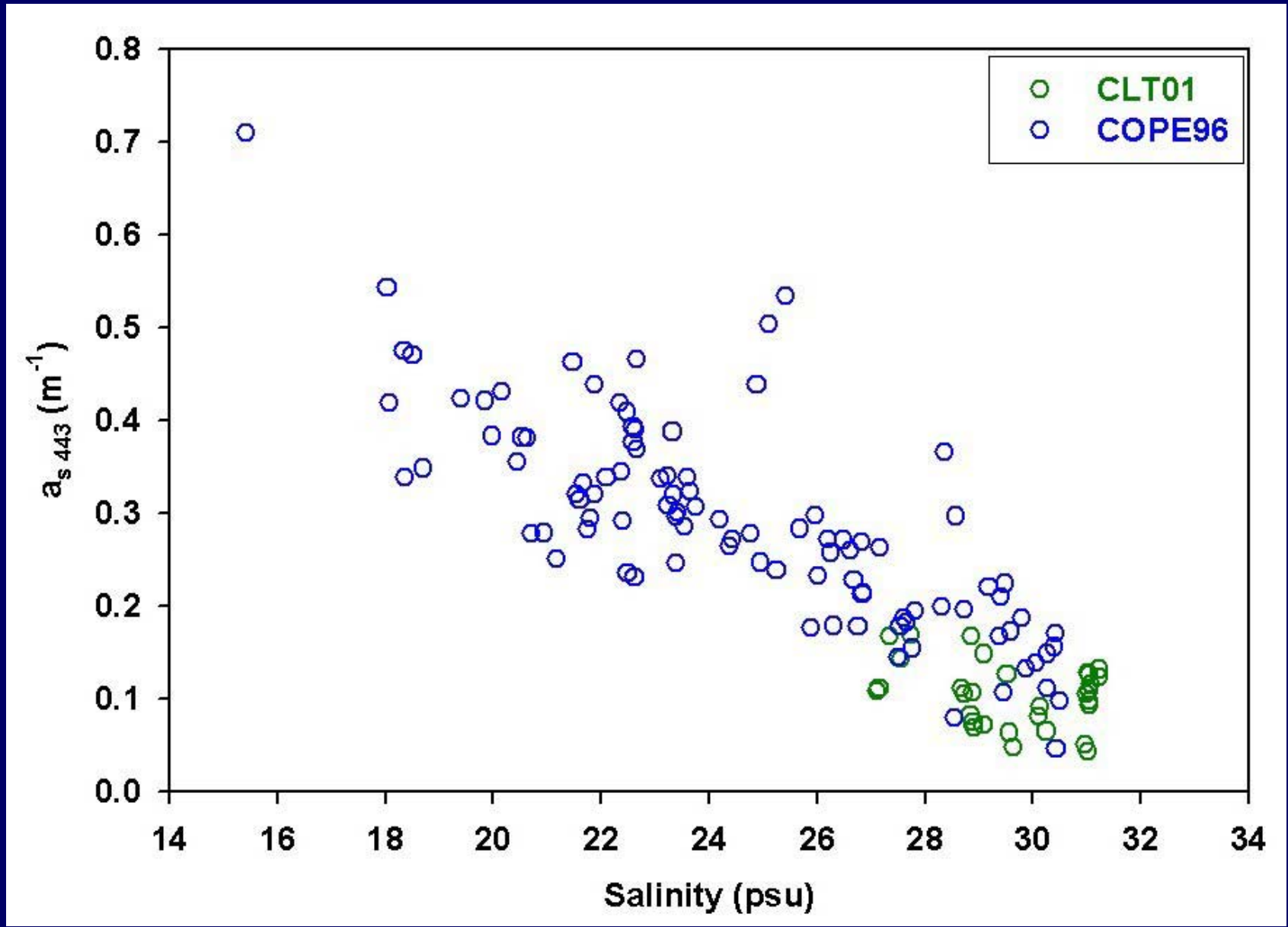


All particles

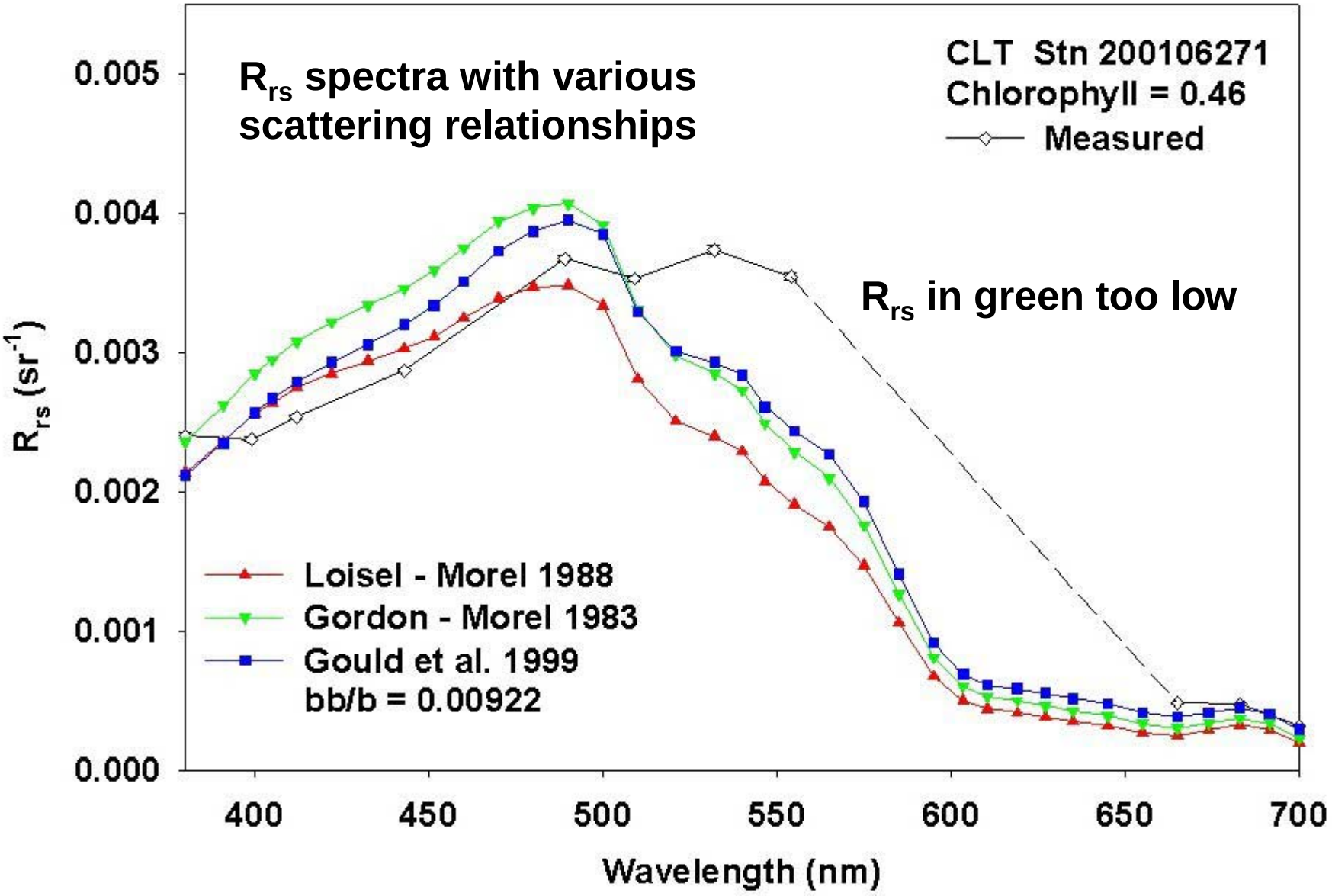
Particles - pigments

Plants

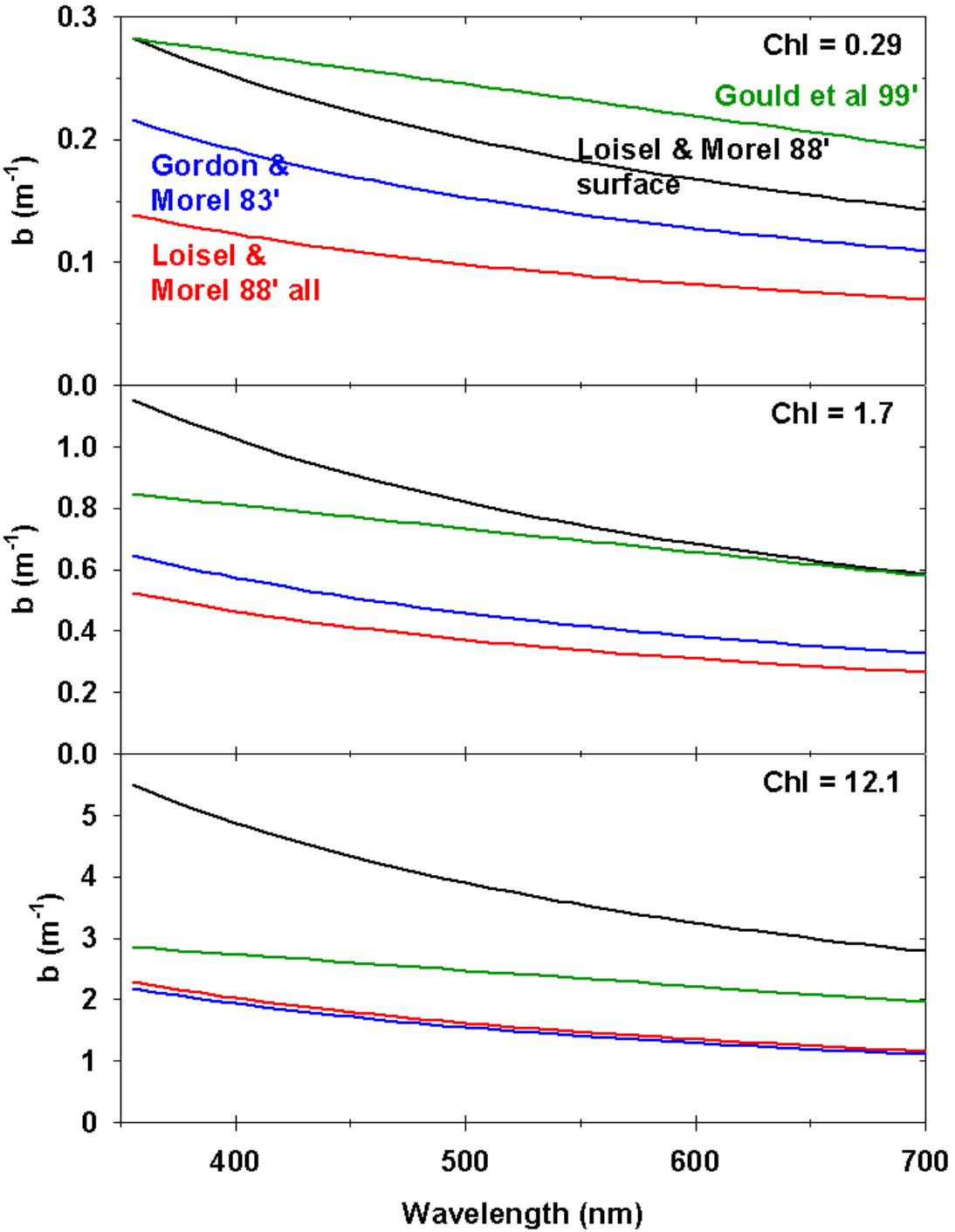
Soluble

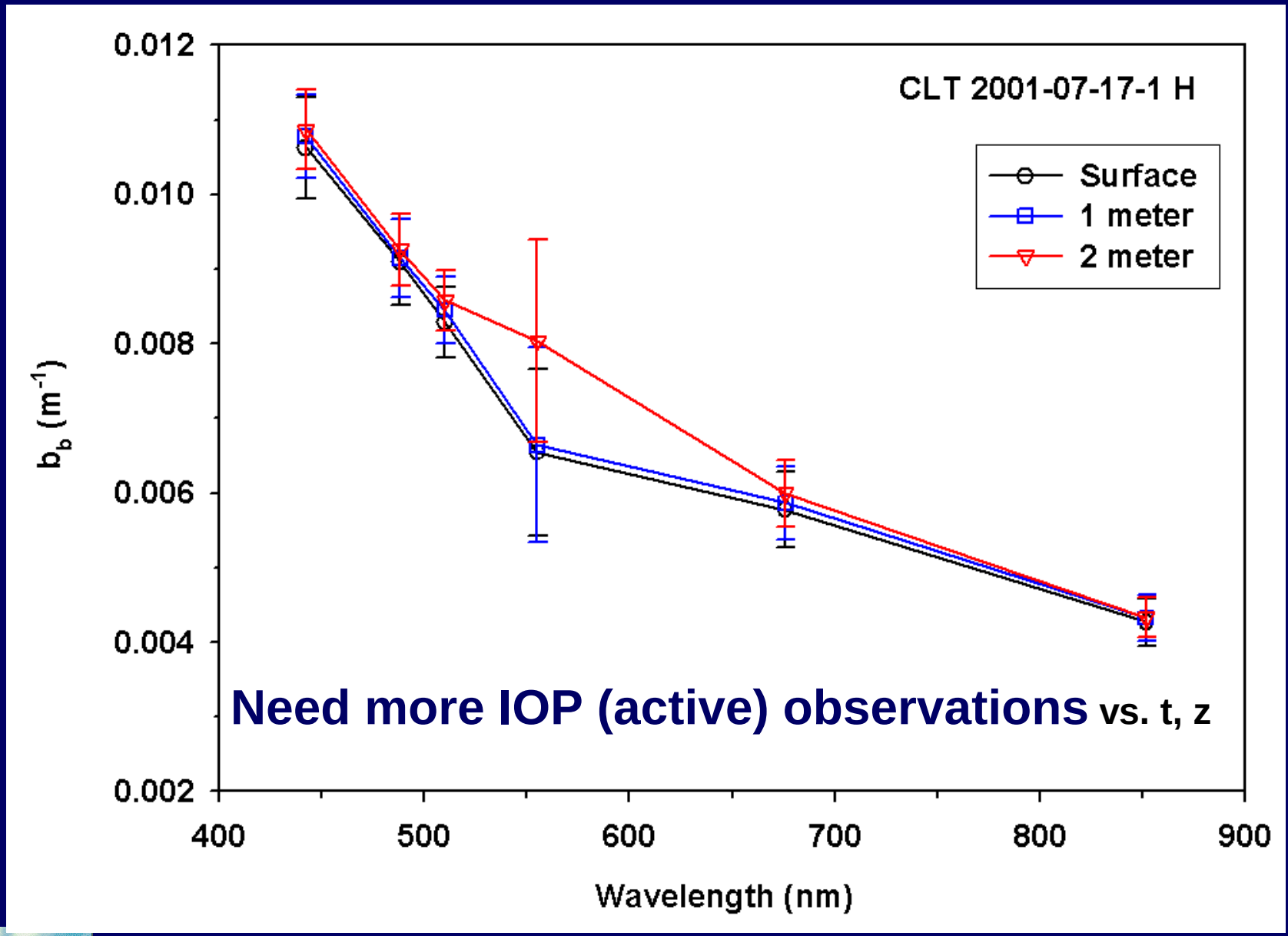


Soluble absorption vs. salinity



Simulations w IOPs and chlorophyll concentrations


Chl = 0.29
Gould et al 99'
Loisel & Morel 88' surface
Gordon & Morel 83'
Loisel & Morel 88' all
Chl = 1.7
Chl = 12.1
b (m-1)
0.0
0.1
0.2
0.3
0.4
0.6
0.8
1.0
1
2
3
4
5
400
500
600
700
Wavelength (nm)



Need more IOP (active) observations vs. t, z

Understanding the dynamics and variability of bio-optical properties in coastal water will require longer, more comprehensive observations (MODIS, GLI, MERIS…) and modeling.

ORCA: http://www.ccpo.odu.edu/~orca/